

CLAIMS

What is claimed is:

6. A waterproof digital electronic camera system comprising:

5 a digital electronic camera having an RS-232 digital electrical signal interface for downloading image information from the camera;

a converter converting signals upon the digital electrical signal interface to serial signals radiating in space;

10 an enclosure hermetically sealing water and air tight both the digital electronic camera and the converter, the enclosure being transparent in at least an area of (i) an optical lens of the digital electronic camera so that pictures may be taken through the enclosure, and (ii) a radiation signal output of the converter
15 so that radiation signals containing image information are communicable exterior to the camera;

said converter comprising:

an RS-232 to TTL signal converter converting RS-232 serial digital electrical signals to Transistor-Transistor Logic (TTL) serial
20 digital electrical signals;

an encoder-decoder converting the TTL electrical signals to electrical signals that are suitably encoded so as to be converted to optical signals for further transmission; and

an electrical-to-optical signal converter converting the encoded
25 electrical signals to optical signals, and transmitting the optical signals through the at least one transparent area of the enclosure.

8. A waterproof digital electronic camera system comprising:

30 a digital electronic camera having a digital electrical signal interface for downloading image information from the camera; said camera having a shutter circuit for activating the shutter, to which shutter circuit electrical connection may suitably be made;

a converter converting signals from the digital electrical signal interface to radiation signals;

an enclosure hermetically sealing water and air tight both the digital electronic camera and the converter, the enclosure being
5 transparent in at least an area of (i) an optical lens of the digital electronic camera so that pictures may be taken through the enclosure, and (ii) a radiation signal output of the converter so that radiation signals containing image information are communicable exterior to the camera;

10 a trigger circuit, also within the enclosure and electrically connected to the shutter circuit of the digital electronic camera, responsive to a stimulus external to the enclosure to produce an electrical signal responsively to which the shutter circuit will activate the shutter of the digital electronic camera;

15 said trigger circuit comprising: a Hall-effect sensor responsive to a magnetic field to produce a signal output; and an amplifier amplifying the signal output of the Hall-effect sensor for application to the shutter circuit as the electrical signal responsively to which the shutter circuit will activate the
20 shutter of the digital electronic camera.

9. A waterproof digital electronic camera system comprising:

a digital electronic camera having a digital electrical signal interface for downloading image information from the camera; said
25 camera having a shutter circuit for activating the shutter, to which shutter circuit electrical connection may suitably be made; a converter converting signals from the digital electrical signal interface to radiation signals;

an enclosure hermetically sealing water and air tight both the
30 digital electronic camera and the converter, the enclosure being transparent in at least an area of (i) an optical lens of the digital electronic camera so that pictures may be taken through the enclosure, and (ii) a radiation signal output of the converter

so that radiation signals containing image information are communicable exterior to the camera;

a trigger circuit, also within the enclosure and electrically connected to the shutter circuit of the digital electronic camera,

5 responsive to a stimulus external to the enclosure to produce an electrical signal responsively to which the shutter circuit will activate the shutter of the digital electronic camera; and said trigger circuit comprising:

10 a reed switch responsive to a magnetic field to gate an electrical signal responsively to which the shutter circuit will activate the shutter of the digital electronic camera.

10. A waterproof digital electronic camera system comprising:

15 a digital electronic camera having a digital electrical signal interface for downloading image information from the camera;

a converter converting signals from the digital electrical signal interface to radiation signals;

20 an enclosure hermetically sealing water and air tight both the digital electronic camera and the converter, the enclosure being transparent in at least an area of (i) an optical lens of the digital electronic camera so that pictures may be taken through the enclosure, and (ii) a radiation signal output of the converter so that radiation signals containing image information are communicable exterior to the camera;

25 a rechargeable power source for providing power to at least the digital electronic camera and the converter; and

a charging circuit, also within the enclosure, for converting some stimuli external to the enclosure to power suitable to recharge the rechargeable power source.

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11. The waterproof digital electronic camera system according to claim 10 wherein the rechargeable power source comprises: a battery.

12. The waterproof digital electronic camera system according to claim 11 wherein the battery is located within a cavity sealed to the exterior of the camera by a frangible membrane; wherein the membrane may be broken, the battery replaced, and the cavity resealed.

13. The waterproof digital electronic camera system according to claim 10 wherein the charging circuit comprises:
an inductive coil in which alternating current is induced by an oscillatory magnetic field external to the enclosure;
a bridge rectifier rectifying the alternating current of the inductive coil to produce a direct current; and
a regulating and charging circuit conditioning the direct current into power to charge the rechargeable power source.

26. A method of communicating with a sealed digital electronic camera comprising:

hermetically housing a digital electronic camera having an RS232 serial digital electrical signal interface for downloading image information from the camera in a housing that is optically transparent in at least an area of a lens of the digital electronic camera so that pictures may be taken through the housing;

converting signals upon the RS232 serial digital electrical signal interface of the digital electronic camera to radiation signals by the steps of:

first-converting RS-232 serial digital electrical signals to Transistor-Transistor Logic (TTL) serial digital electrical signals in a RS-232 to TTL signal converter;

second-converting the TTL electrical signals to electrical signals that are suitably encoded so as to be converted to optical signals for further transmission in an encoder-decoder; and

third-converting the encoded electrical signals to optical signals,
and transmitting the optical signals through the enclosure, in an
electrical-to-optical signal converter; and
radiatively communicating the radiation signals through the
5 housing.

28. A method of communicating with a sealed digital electronic
camera comprising:

10 hermetically housing a digital electronic camera having a digital
electrical signal interface for downloading image information from
the camera in a housing that is optically transparent in at least
an area of a lens of the digital electronic camera so that
pictures may be taken through the housing;
converting signals upon the digital electrical signal interface of
15 the digital electronic camera to radiation signals;
radiatively communicating the radiation signals through the
housing;
activating a shutter in and by a shutter circuit to which
electrical connection may suitably be made; and
20 triggering the shutter circuit in and by a trigger circuit, also
within the enclosure and electrically connected to the shutter
circuit of the digital electronic camera, responsive to a stimulus
external to the housing; wherein the triggering of the shutter
circuit is in and by a Hall-effect trigger circuit.

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29. A method of communicating with a sealed digital electronic
camera comprising:
hermetically housing a digital electronic camera having a digital
electrical signal interface for downloading image information from
30 the camera in a housing that is optically transparent in at least
an area of a lens of the digital electronic camera so that
pictures may be taken through the housing;

converting signals upon the digital electrical signal interface of the digital electronic camera to radiation signals; radiatively communicating the radiation signals through the housing;

- 5 activating a shutter in and by a shutter circuit to which electrical connection may suitably be made; and triggering the shutter circuit in and by a trigger circuit, also within the enclosure and electrically connected to the shutter circuit of the digital electronic camera, responsive to a stimulus
10 external to the housing; wherein the triggering of the shutter circuit is in and by a reed switch trigger circuit.

30. A method of communicating with a sealed digital electronic camera comprising:

- 15 hermetically housing a digital electronic camera having a digital electrical signal interface for downloading image information from the camera in a housing that is optically transparent in at least an area of a lens of the digital electronic camera so that pictures may be taken through the housing;
- 20 converting signals upon the digital electrical signal interface of the digital electronic camera to radiation signals; radiatively communicating the radiation signals through the housing;
- 25 providing power to at least the digital electronic camera with a rechargeable power source; and converting some stimulus external to the enclosure into power to recharge the rechargeable power source.

31. The method according to claim 30 wherein the converting
30 comprises:
inducing an alternating current in an inductive coil inside the housing;

rectifying in a bridge rectifier the alternating current of the inducing to produce a direct current; and
regulating and conditioning the direct current into power to charge the rechargeable power source.

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39. A digital electronic camera CHARACTERIZED IN THAT:
the optics and electronics of the camera are permanently within a solid mass of optically clear dielectric material;
the camera is potted inside and out in a solid block of said
10 optically clear dielectric material;
the camera contains essentially no gases whatsoever; and
communication of image data from the camera to the exterior of the solid mass is via an optical link;
wherein the camera may suitably be immersed to a depth of at least
15 a mile within the ocean without crushing.

40. A digital electronic camera CHARACTERIZED IN THAT:
the optics and electronics of the camera are permanently within a solid mass of optically clear dielectric material;
20 the camera is potted inside and out in a solid block of said optically clear dielectric material;
the camera contains essentially no gases whatsoever; and
communication of an actuation signal to a shutter of the camera is via a magnetic link;
25 wherein the camera may suitably be immersed to a depth of at least a mile within the ocean without crushing.

41. A digital electronic camera CHARACTERIZED IN THAT:
the optics and electronics of the camera are permanently within a
30 solid mass of optically clear dielectric material;
the camera is potted inside and out in a solid block of said optically clear dielectric material;
the camera contains essentially no gases whatsoever; and

communication of power to the camera is via inductive coupling; wherein the camera may suitably be immersed to a depth of at least a mile within the ocean without crushing.

5 42. A waterproof digital electronic camera system comprising:
a digital electronic camera having a digital electrical signal
interface for downloading image information from the camera;
a converter converting signals from the digital electrical signal
interface to radiation signals; wherein the converter is
10 converting signals from the digital electrical signal interface to
serial signals radiating in space;
a shutter circuit for activating the shutter, to which shutter
circuit electrical connection may suitably be made;
a trigger circuit, also within the enclosure and electrically
15 connected to the shutter circuit of the digital electronic camera,
responsive to a stimulus external to the enclosure to produce an
electrical signal responsively to which the shutter circuit will
activate the shutter of the digital electronic camera;
a rechargeable power source for providing power to at least the
20 digital electronic camera and the converter;
a charging circuit, also within the enclosure, for converting some
stimuli external to the enclosure to recharge the rechargeable
power source; and
an enclosure hermetically sealing water and air tight both the
25 digital electronic camera and the converter, the enclosure being
transparent in at least an area of (i) an optical lens of the
digital electronic camera so that pictures may be taken through
the enclosure, and (ii) a radiation signal output of the converter
so that radiation signals containing image information are
30 communicable exterior to the enclosure.

43. The waterproof digital electronic camera system according to
claim 42

wherein the digital electronic camera has an RS-232 serial digital electrical signal interface; and

wherein the converter is converting signals from the RS-232 serial digital electrical signal interface to serial signals radiating in space.

44. The waterproof digital electronic camera system according to claim 43 wherein the converter comprises:

an RS-232 to TTL signal converter converting RS-232 serial digital electrical signals to Transistor-Transistor Logic (TTL) serial digital electrical signals;

an encoder-decoder converting the TTL electrical signals to electrical signals that are suitably encoded so as to be converted to optical signals for further transmission; and

an electrical-to-optical signal converter converting the encoded electrical signals to optical signals, and transmitting the optical signals through the at least one transparent area of the enclosure.

45. The waterproof digital electronic camera system according to claim 42 wherein the trigger circuit comprises:

a Hall-effect sensor responsive to a magnetic field to produce a signal output; and

an amplifier amplifying the signal output of the Hall-effect sensor for application to the shutter circuit as the electrical signal responsively to which the shutter circuit will activate the shutter of the digital electronic camera.

46. The waterproof digital electronic camera system according to claim 42 wherein the trigger circuit comprises:

a reed switch responsive to a magnetic field to gate an electrical signal responsively to which the shutter circuit will activate the shutter of the digital electronic camera.

47. The waterproof digital electronic camera system according to claim 42 wherein the rechargeable power source comprises: a battery.

5 48. The waterproof digital electronic camera system according to claim 47 wherein the battery is located within a cavity sealed to the exterior of the camera by a frangible membrane; wherein the membrane may be broken, the battery replaced, and the cavity resealed.

10 49. The waterproof digital electronic camera system according to claim 42 wherein the charging circuit comprises:

an inductive coil in which alternating current is induced by an oscillatory magnetic field external to the enclosure;

15 a bridge rectifier rectifying the alternating current of the inductive coil to produce a direct current; and

a regulating and charging circuit conditioning the direct current into power to charge the rechargeable power source.

20 50. A method of communicating with a sealed digital electronic camera comprising:

hermetically housing a digital electronic camera having a digital electrical signal interface for downloading image information from the camera in a housing that is optically transparent in at least
25 an area of a lens of the digital electronic camera so that pictures may be taken through the housing:

converting signals from the digital electrical signal interface of the digital electronic camera to radiation signals; and

radiatively communicating the radiation signals through the
30 housing:

first-converting RS-232 serial digital electrical signals to Transistor-Transistor Logic (TTL) serial digital electrical signals in a RS-232 to TTL signal converter;

second-converting the TTL electrical signals to electrical signals that are suitably encoded so as to be converted to optical signals for further transmission in an encoder-decoder;

5 third-converting the encoded electrical signals to optical signals, and transmitting the optical signals through the enclosure, in an electrical-to-optical signal converter.

activating a shutter in and by a shutter circuit to which electrical connection may suitably be made;

10 triggering the shutter circuit in and by a trigger circuit, also within the enclosure and electrically connected to the shutter circuit of the digital electronic camera, responsive to a stimulus external to the housing

providing power to at least the digital electronic camera with a rechargeable power source;

15 converting some stimulus external to the enclosure into power to recharge the rechargeable power source.

51. The method according to claim 50 wherein the converting comprises:

20 inducing an alternating current in an inductive coil inside the housing;

rectifying in a bridge rectifier the alternating current of the inducing to produce a direct current; and

25 regulating and conditioning the direct current into power to charge the rechargeable power source.

52. The method according to claim 50 further wherein the triggering of the shutter circuit is in and by a Hall-effect trigger circuit.

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53. The method according to claim 50 further wherein the triggering of the shutter circuit is in and by a reed switch trigger circuit.

54. A digital electronic camera CHARACTERIZED IN THAT the optics and electronics of the camera are permanently within a solid mass of optically clear dielectric material, and the camera contains
5 essentially no gases whatsoever;

wherein the camera may suitably be immersed to a depth of at least a mile within the ocean without crushing;

wherein the camera is potted inside and out in a solid block of said optically clear dielectric material;

10 wherein the camera is within an optically clear liquid dielectric material;

wherein the camera and its liquid are held within a liquid-tight exterior case that is itself optically clear in at least a region where an image is received through the case and into a lens of the
15 camera;

wherein image data is communicated from the camera to the exterior of the solid mass;

wherein an actuation signal is communicated to a shutter of the camera from the exterior of the solid mass;

20 wherein the power source for the camera is rechargeable; and
wherein power is communicated to the power source from the exterior of the solid mass.

55. The digital electronic camera according to claim 54 FURTHER
25 CHARACTERIZED IN THAT said optically clear liquid dielectric material is ethanol.

56. The digital electronic camera according to claim 54 FURTHER
CHARACTERIZED IN THAT communication of the image data is via an
30 optical link.

57. The digital electronic camera according to claim 54 FURTHER CHARACTERIZED IN THAT communication of the actuation signal is via a magnetic link.

- 5 58. The digital electronic camera according to claim 54 FURTHER CHARACTERIZED IN THAT communication of power to the power source is via inductive coupling.